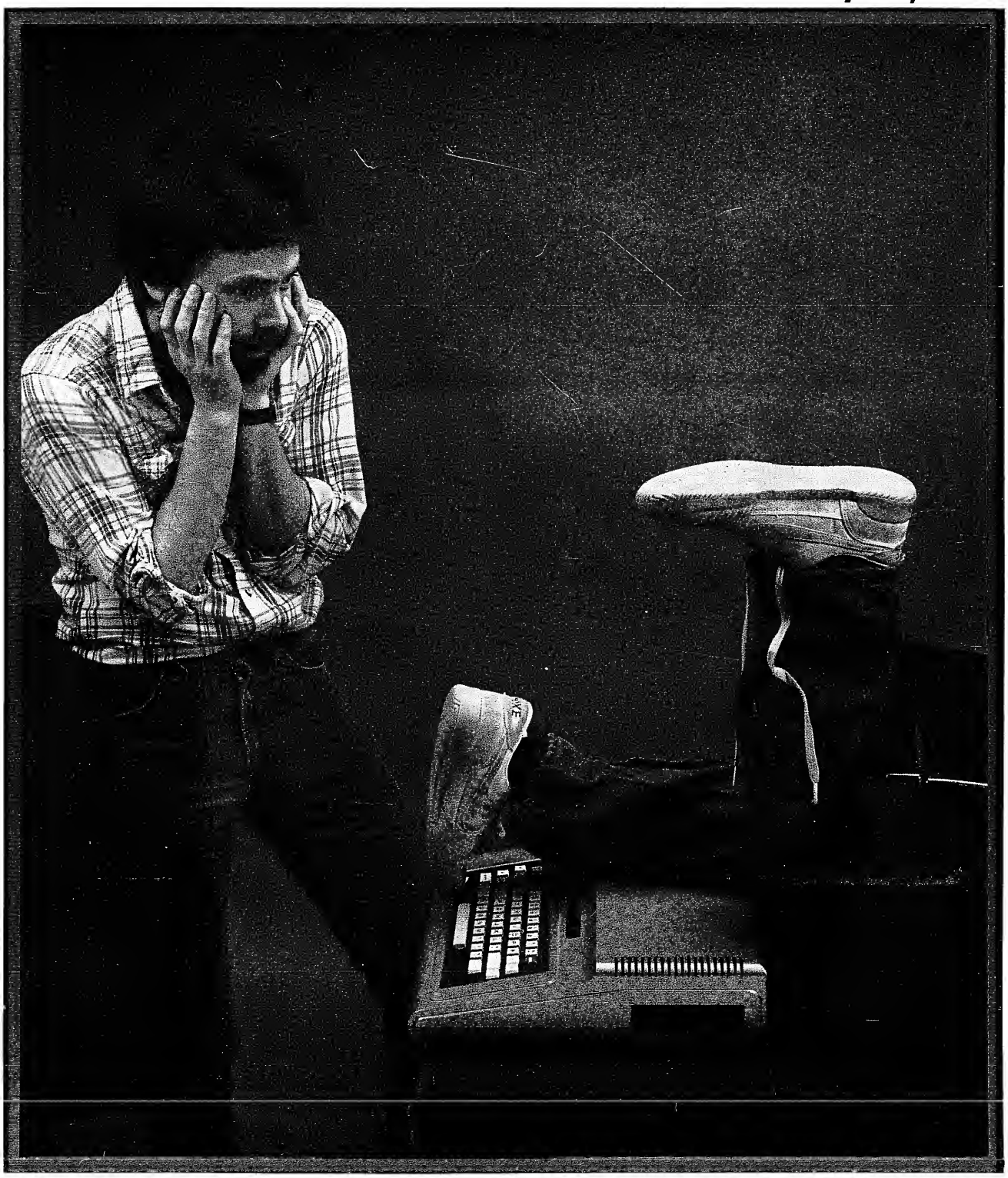
UNDERCOLOR

Vol. 1 No. 5 **February 20, 1985**



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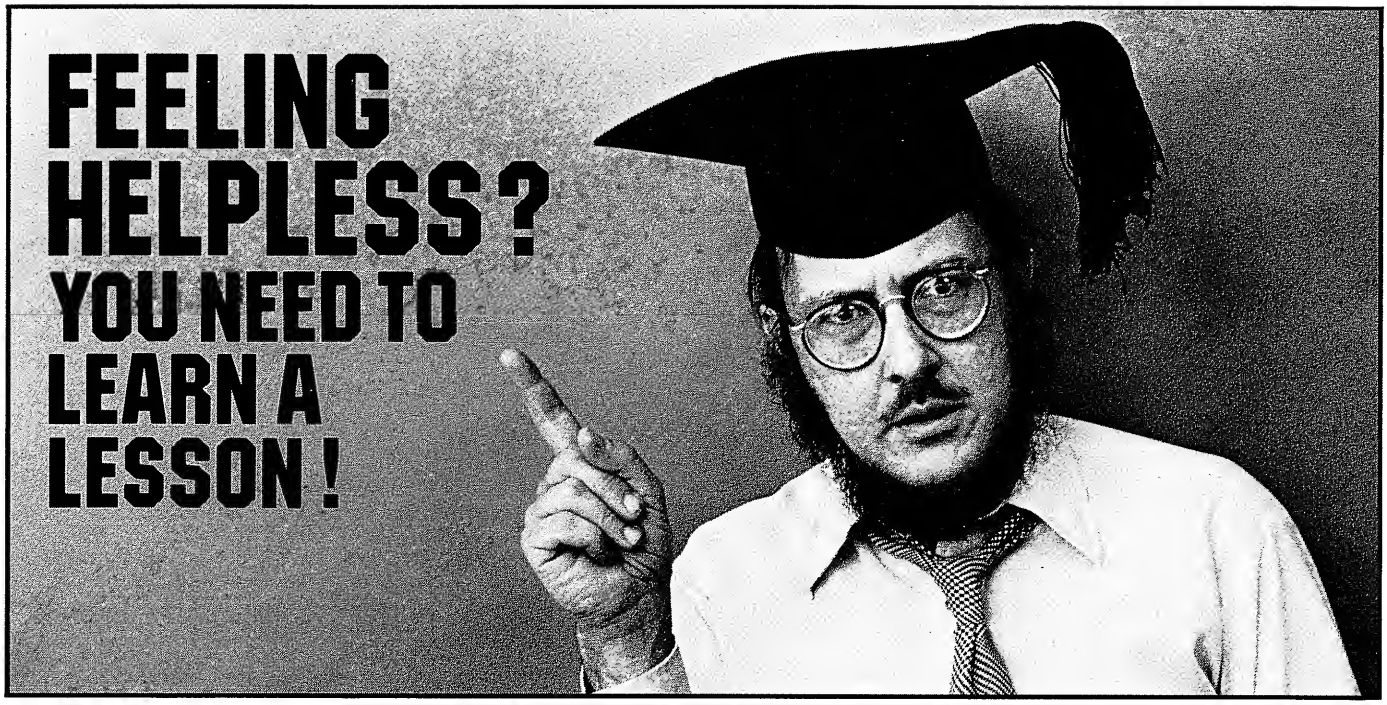

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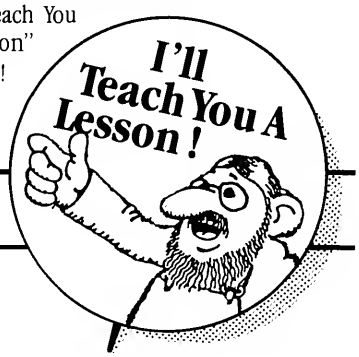

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Cover Photo by Charles Freiberg

Defust

By Terry Kepner

I have been trying to get information on what I would need to be able to communicate with some bulletin boards. I know nothing more than that I need a modem (which I knew in the beginning). I would also like to know if it is expensive to communicate with a bulletin board.

What would be the best modem to buy for a 16K Extended Color Basic TRS-80?

Doug Eddins
Gulf Breeze, FL

You need a computer, a modem, access to a telephone line, and a telecommunications program, such as Colorcom/E. When you have all these assembled together, load the telecommunications program and set the RS-232 parameters (either 300 baud, seven bit words, one stop bit, and even parity; or 300 baud, eight bit words, two stop bits, and no parity). Most *bulletin boards* use 300, 7, 1, and even. Most *Color Computer specific boards* use 300, 8, 2, and none.

Expense depends on whom you call. The only charge for most public BBS's is the phone call charge. Private databases that require membership charge anywhere from $6 an hour up to $300 an hour.

I currently own a 16K Extended Basic 1.0 Color Computer purchased in December 1982. Wanting to upgrade to 64K without the $70 plus $15 installation charge, I opened my computer to find out which revision board I own. Since nothing was printed below the cartridge port, I looked to the lower left-hand corner of the board to see this printed: TRW/CG1159V1 Rev-NC. I assume that NC is my revision board, but I had thought that NC and ET boards were only used in the TDP System 100. Then I looked back to the Review section TCCM's *first issue—March 1983—where was explained the procedure for upgrading to 64K. The article mentions three jumpers, two bare staking pins, a more pronounced clicking when the computer or tape recorder is turned on, the PIA's numbered U17 and U18 and the Basic and Extended Basic chips being moved to the center of the board. This all perfectly describes my board.*

I would appreciate the method for a 64K upgrade of this computer being printed, and I hope that it will help other confused NC or ET revision board owners, if that is, in fact, what I own. If it is true, I would like to know where I can get a new technical manual. Since I purchased my computer with the understanding that it was "normal," do I have the right to the manual, two joysticks and Super-Bustout ROMpak that come with it? Mentioned in the article in the first issue of The Color Computer Magazine *was the cutting-out of eight capacitors. Please go into detail about these, for I have no idea of what was being talked about. Also, I have Extended Basic 1.0, which originally was Basic 1.1. Is Extended Basic 1.1 better? If so, how can I get a new chip?*

D. Barbier
Cheshire, CT

The upgrade to 64K for the NC computer was covered in the October 1983 issue of *The Color Computer Magazine*, in Dennis Kitsz's Custom Color Column, plus corrections. Write to Dennis if you have no access to the article.

You can get a technical manual from Tandy National Parts, 900 E. Northside Drive, Fort Worth, TX 76102, 817-870-5662. Mastercharge and Visa are accepted and each order includes a $1.50 handling charge. Ask for the Color Computer Technical Manual NC revision update.

Just because you have the NC version doesn't mean you get the accessories that came with the TDP-100. Remember that the TDP-100 cost more than the Color Computer.

The only ROM revisions you need to worry about are in Standard Basic. The 1.1 ROM corrects some problems in the 1.0 ROM. The 1.3 ROM is for the new white-case Color Computer. Since you already have the 1.1 ROM, you don't need to upgrade.

I recently sent you a question concerning adapting a Racal-Vadic modem to the Color Computer.

You said in your reply that you did not have access to an IBM 8775 terminal or the above modem, so I probably didn't supply you with enough information concerning the modem (I thought it was a common modem). Enclosed you'll find a little more information from the operation manual.

From what you described (and what I read since) am I correct to say this modem will not work with the CoCo because of its 2400 bps synchronous operation? What's the difference between baud and bps? Note the VA2455-series (from enclosure) has a 75 or 150 bps asynchronous secondary channel. Is there any hope if I get my hands on one of these?

Samuel Murphy, Jr.
Burlington, NJ

While the Color Computer can work at 2400 baud, I don't think it will in synchronous operation (which allows data to follow simultaneously in both directions).

Assuming the Racal-Vadic uses standard RS-232C connections, all you have to do is set the Color Computer to the 150 bps mode (POKE 149,1:POKE 150,110) and make a cable that connects the 4-pin DIN connector to a DB25 connector.

Unfortunately, this will make it almost impossible to use on bulletin board systems because most of them use modems set to either 300 baud or 1200 baud.

Your best choice is to just get a standard 300 baud modem (the Volksmodem is inexpensive and available at most computer stores, the R/S modems are more expensive and work the same).

BPS (bits per second) is a slightly more descriptive acronym for baud. Three hundred baud translates to 300 bps. Translating those to characters-per-second is harder since you must know the word-size, number of start and stop bits, and if parity-checking is available.

**Ed's Note: Info from readers informs us that the Racal-Vadic VA 2450 is a 2400 bps direct-connect synchronous modem. It is Bell 201 b or c compatible. It requires an asynchronous computer operating at 300 or 1200 baud, similar to the Vadic 212.*

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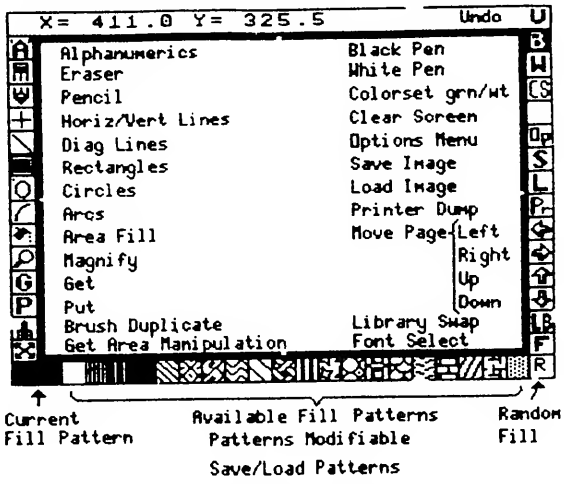
BY GEORGE ZINIEWICZ AUTHOR OF COLOR TOOLKIT



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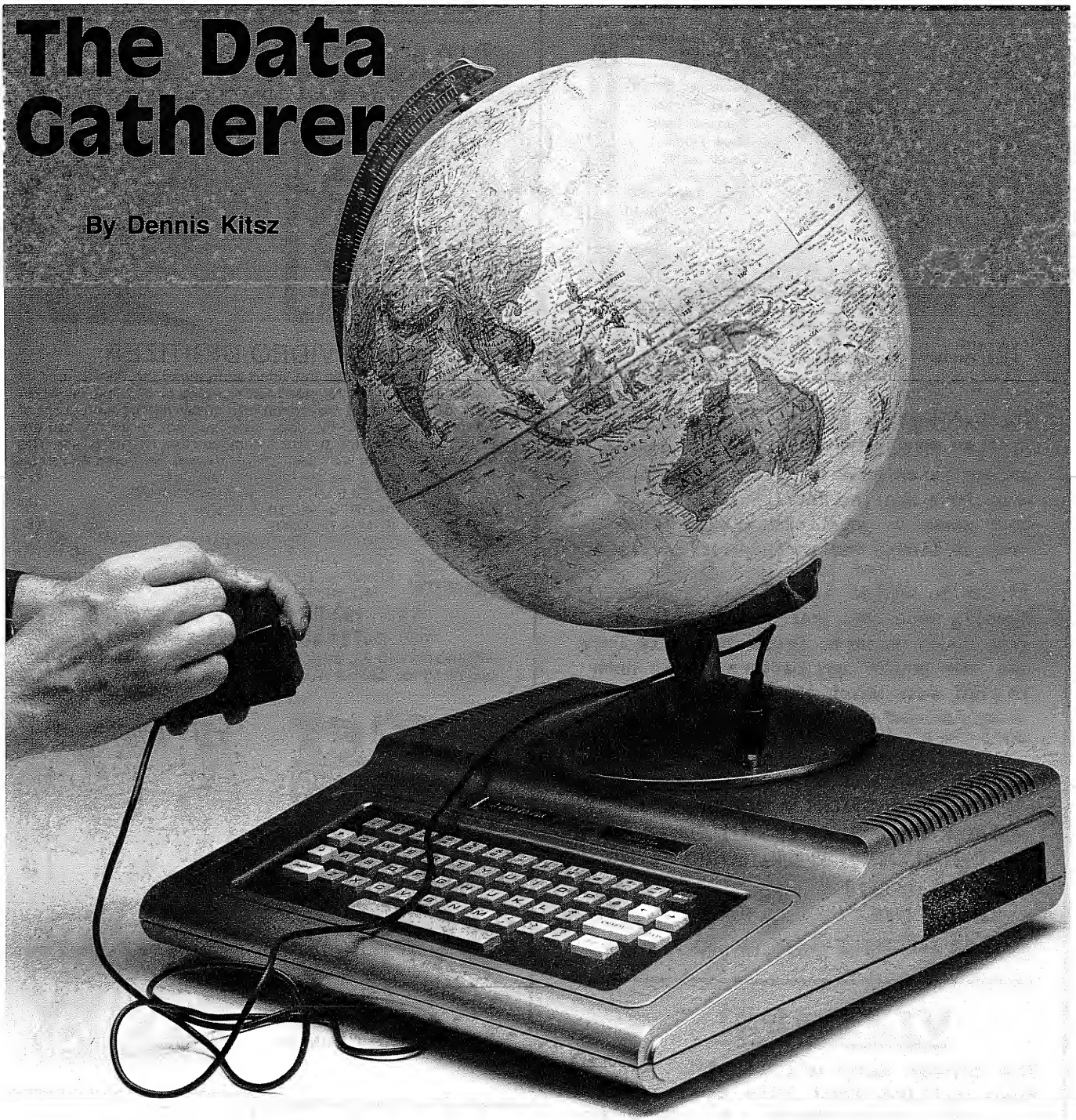
The Data Gatherer

By Dennis Kitsz



Part III

The Data Gatherer, the complete data acquisition system for the Color Computer, is a complex project to construct, especially if you "scratch build" it. The schematic (see issue 4) is quite formidable. Fortunately you have two options that ease the way somewhat: you can obtain a ready-made circuit board and stuff it with parts, or, if you prefer to do it entirely yourself, you can build and test the unit as nine separate modules.

The modular way is how I constructed the prototype . . . but I cheated a little, using a pair of my CoCoPort input/output ports and one of my ColorPak ROM cartridges as building blocks. Creating the whole thing from scratch was too much for me! I used 16-pin plug-in headers to simplify debugging my modules; that way I didn't have to desolder a board to check my connections.

Even if you're not going to build the Data Gatherer from scratch, read on. You'll get an idea of the practical considerations in working with such a project.

The Power Supply

In order to test anything in the Data Gatherer, you will need a power supply. The full schematic presented last time shows only connections for +12 and −12 volts from an off-board power supply. Plus or minus 12 volt power supplies are relatively common, and can be obtained from such surplus houses as BNF Enterprises; if you need to build that section, Fig. 1 presents a simple +/− 12 volt supply.

The on-board power supply for the Data Gatherer is important because it has to be clean and quiet. Keep wires as short as possible. Don't use a cheap commercial power supply for this job; instead, use the circuit in Fig. 2. Capacitors C21 and C22 should be small monolithic ceramic or glass types, and must be physically placed where the +/−12 volts are connected to the Data Gatherer board. This halts some power supply noise right at the front steps.

The C28/C30 and C27/C29 monolithic/electrolytic pairs should be physically close together and placed near U14, the +5 volt regulator. C16 and C14 should be next to their respective input and output pins on U14, and must be connected together at the ground of U14. Electrolytic capacitor C19 should be nearby. The capacitor pairs further reduce outboard noise and help stabilize the line; the capacitors right on the regulator keep the regulator's own noise off the line.

Finally, the two 13-volt zener diodes D4 and D5 should be placed at the far end of the +12 volt and −12 volt lines, at the point where those lines will (eventually) connect with U4 and U13. These zeners are essentially over-voltage protectors, preventing occasional glitches from getting to the sensitive and expensive D/A converter.

You must be careful about physical placement because any noise contributed by the power supply will affect the operation of the digital-to-analog converter and voltage comparator. The longer the power supply wires, the more likely they will act as receiver antennas, listen in on all the digital noise around them, and send all that garbage to the converter section. Reliability of the converter will be degraded, and its .025 percent rated accuracy will be lost.

Using a digital volt meter, turn on the power supply and make sure it is correct to within 10 percent, and that it is stable and doesn't wander. This should be true for all three voltages (+12, −12 and +5).

The Operating System Module

Continue by building the Data Gatherer Operating System (DGOS) module. You can simplify your work by purchasing one of the dozen or so commercial blank ROM cartridges, and burning the operating system (coming!) into an EPROM. Then you're ready to build the next module. Otherwise, read on.

The operating system is short—less than 2K. However, DGOS is both expandable and contains an auto-boot routine to download and run a Basic program. So, if you will be writing your own assembly language programs to interface with the Data Gatherer, a 2716 (2K) or 2732 (4K) EPROM will provide plenty of read-only memory space. The operating system's auto-boot routine, though, requires using a 2764/68764/68766 (8K) or 27128 (16K) EPROM in order to store DGOS plus the Basic program itself. (I'll present the details of those routines later. As you construct the operating system module, just keep in mind that it should be wired for the EPROM you'll be using.)

All that is necessary to construct the operating system module is a small perforated board and a 28-pin socket for the EPROM. Leave some space on the perfboard for a few extra integrated circuits—two for disk compatibility and two for the "swap" system. If you want disk compatibility, you'll need a 74LS04 and a 74LS32 integrated circuit; I'll discuss the swap system later. Figure 3 shows the DGOS module. All eight data lines (computer pins 10–17) are wired directly to the socket, as are 13 address lines (computer pins 19–31). Also, attach the ground (computer pins 33 and 34), and +5 volts and ground from your newly assembled power supply module. Be sure to include C15, the 0.1 mF decoupling capacitor, near the socket.

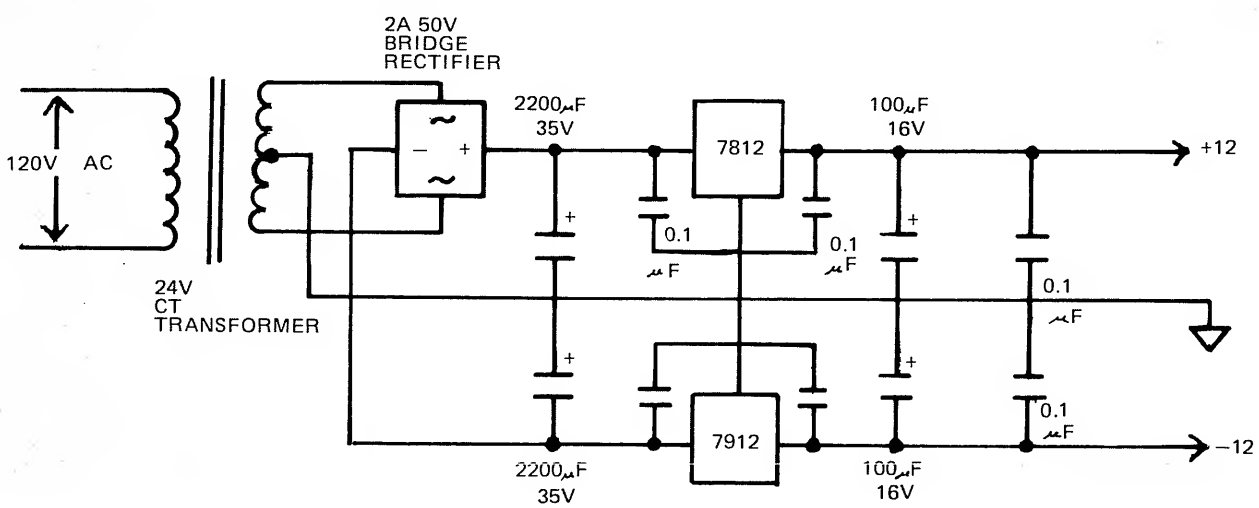


Figure 1. Simple +/−12 volt power supply uses stock components available from Radio Shack.

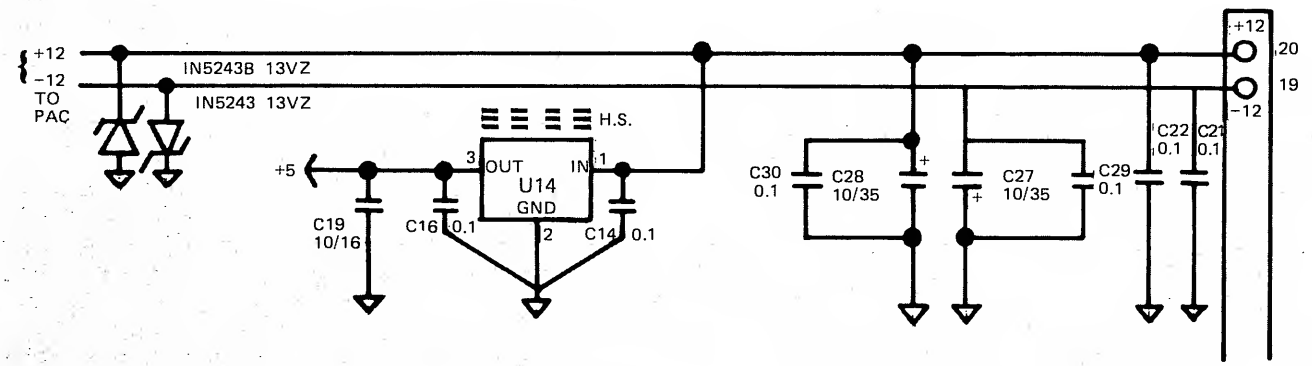


Figure 2. On-board power supply regulation and +5 volt supply.

To test this module, temporarily hook CTS* (computer pin 32) to pins 20 and 22 of the EPROM socket, and install a 2764 EPROM with known contents. This will select the EPROM at $C000, the normal place in memory for a ROM cartridge. Turn on the power to the module and to the computer.If you've installed an auto-boot ROM of some kind, it should be satisfactory; otherwise, enter and run the following lines:

```
10 FOR X = &HC000 TO &HDFFF
20 PRINT HEX$(PEEK(X))" ";
30 NEXT X
```

The contents of the EPROM will be displayed in hexadecimal. If the EPROM contains numerous messages in ASCII, change Line 20 to read:

```
20 PRINT CHR$(PEEK(X));
```

If everything looks right (as far as you can tell about the ROM you've installed), remove the power and disconnect the CTS* line. Rewire CTS* together with the sockets for U8 and U11 as shown. Now the EPROM will be placed at $E000, above the normal ROM cartridge position. Install U8 and U11 in their sockets, restore power and change Line 10 in the program above to read:

```
10 FOR X =&HE000 TO &HFEFF
```

Listing 1. Clock Test

```
1 CLS:POKE&HFF58,255:X=&HFF40
2 POKEX,0:Y=15
3 PRINT@260,PEEK(X+7)AND3;
4 PRINTPEEK(X+6)ANDY":";
5 PRINTPEEK(X+5)ANDY;
6 PRINTPEEK(X+4)ANDY":";
7 PRINTPEEK(X+3)ANDY;
8 PRINTPEEK(X+2)ANDY".";
9 PRINTPEEK(X+1)ANDY;
10 GOTO3
```

If any problems arise with either arrangement, check your wiring and soldering (or wire wrapping). Make sure this module works reliably before proceeding.

The Decoder Module

Central to getting the most out of the little room in the Color Computer's memory map is the decoder module. Prepare this module, shown in Fig. 4, next. Again, you'll need a small

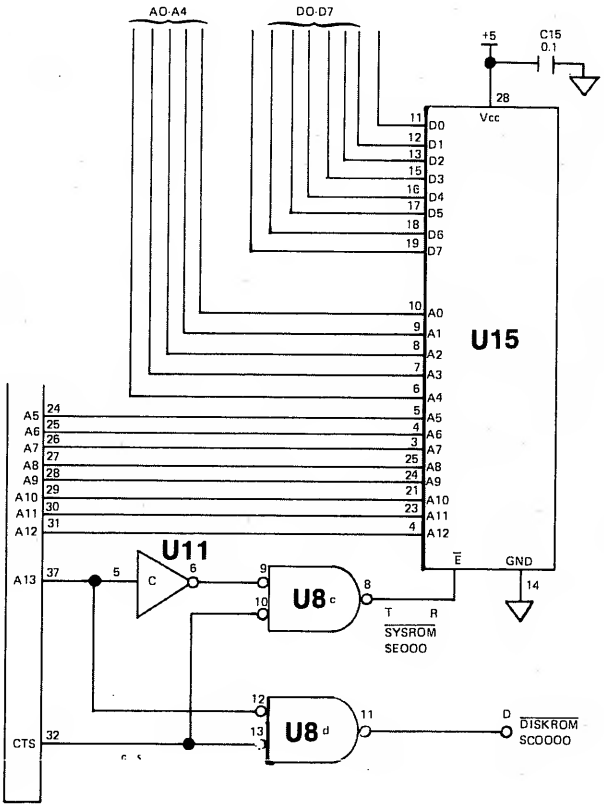


Figure 3. Data Gatherer Operating System (DGOS) EPROM select module.

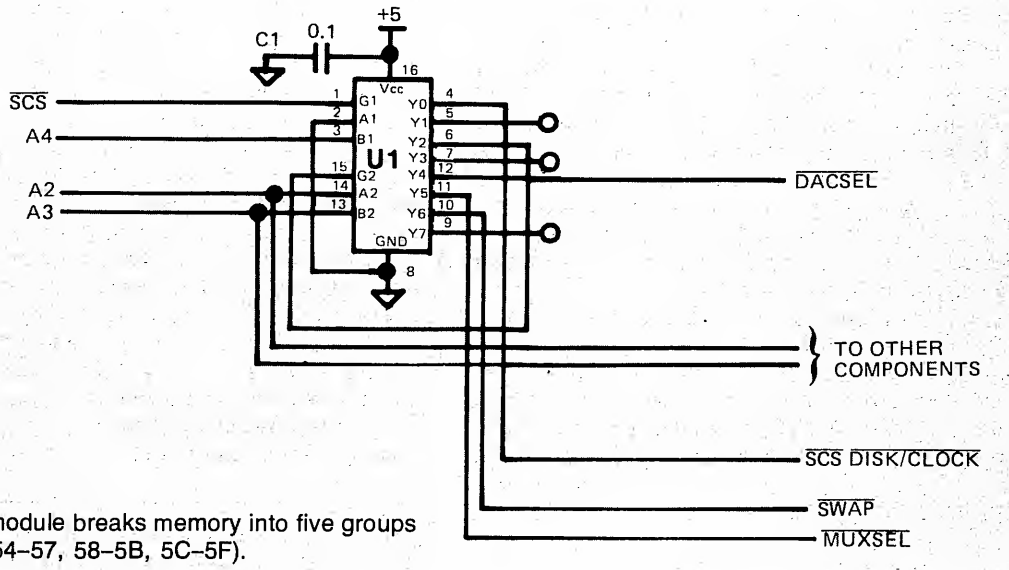


Figure 4. Decoder module breaks memory into five groups ($FF40–4F, 50–53, 54–57, 58–5B, 5C–5F).

perfboard, plus a 16-pin socket. The wiring is simple; don't forget C1, the decoupling capacitor; it is particularly important here because the 74S139 (U1) switches extremely quickly and causes a great deal of strain on the local power pool.

Install U1 in its socket. Hook up 5 volts and ground, and fire up the system again. There's no way to test this module's operation without an oscilloscope, but so long as everything powers up normally, you can continue with the next step.

The Swap System Module

The swap system provides the tricky business of selecting either the real-time clock/calendar or the disk drive. Even if you're not going to use a disk, select this section. It will keep you compatible with any upgrade you do, since it's very difficult to retrofit a project like this once you get it working. (I tend to forget what I've done, and usually have to build a new module!)

Examine Fig. 5. The swap system uses U7, U8, U11 and U12. Since part of U8 and U11 have already been used for the operating system module, you should build this on the same piece of perfboard, or mount it nearby.

You will need D0, Reset*, R/W* and E from the computer, plus the special disk SCS* from the decoder module. Recall that the Reset* line makes sure the disk system is selected on power-up. The wiring is not critical, but be sure to use decoupling capacitors near all the integrated circuits (C7, C8, C11 and C12). Place 56 pF capacitor C26 and 1K resistor R4 near U7; these devices prevent false triggering of the swap mode, especially in a hand-wired version of the Data Gatherer.

Install the integrated circuits in their sockets. Once again, apply power and be sure that all seems normal. This section cannot be tested without special equipment, so double-check all your wiring before moving on.

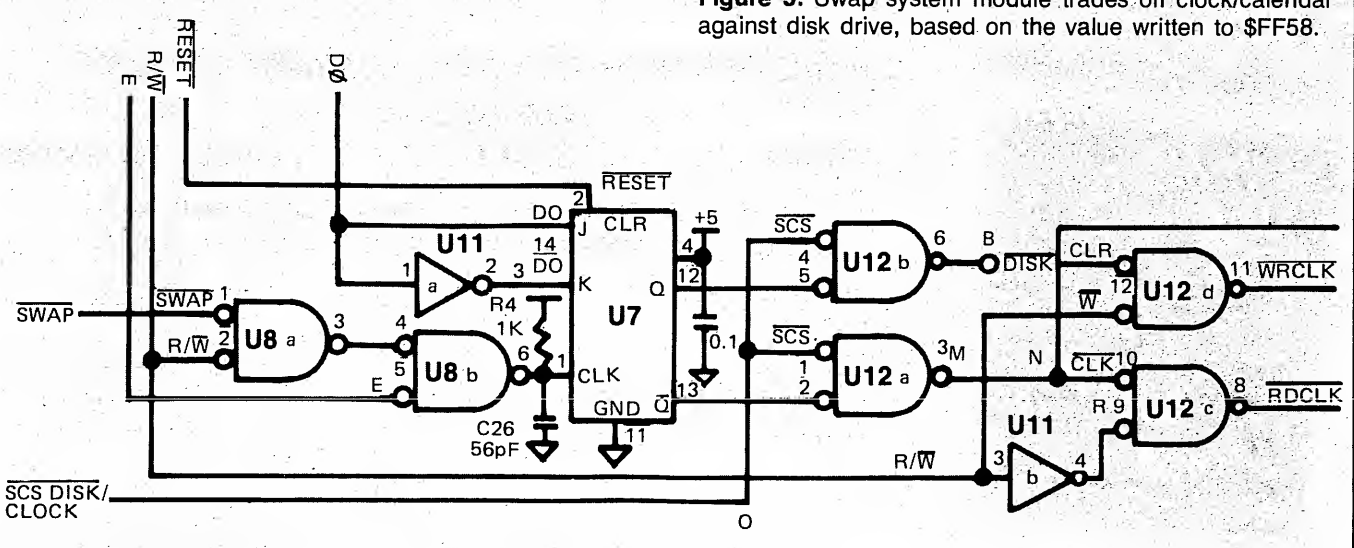


Figure 5. Swap system module trades off clock/calendar against disk drive, based on the value written to $FF58.

The Clock/Calendar Module

The clock/calendar module has a messy group of parts—all sizes and shapes, only one convenient socket, and worst of all, a delicate CMOS integrated circuit to deal with.

Again, a 16-pin socket and a section of perfboard will do nicely. But this time use "flea clips," draw the pattern of parts hook-up on the board, and wire the flea clips on the bottom of the perfboard. Work according to the schematic shown in Fig. 6. Finally, solder the parts to the flea clips (all but the integrated circuit U10), being quick and careful; don't overheat anything! The diodes, transistors and crystal are particularly susceptible to heat damage, and the plastic in the small variable capacitor can melt.

About the battery: you can use a stack of rechargeable batteries if you wish (they're called 1/3 AA and come with pins or tabs), but with the circuit shown, a "primary" cell such as a tiny mercury or lithium battery will work for several years without replacement. If you do use a primary cell, it is very important that you *not* include resistor R5, and that you be extremely cautious when soldering. Lithium cells in particular can be effective, but dangerous. In either case, don't connect the battery yet; leave the positive side free.

Before installing U10, wire the entire board and hook it to the swap module, the computer, and the power supply. Turn on the power and do the usual check for a proper power up, then power down again.

Handle the CMOS clock/calendar chip with great care. Do your work in a static-free environment (some humidity in the air), and on a conductive mat or foil surface. Insert U10 in the socket, and do a final double-check of your assembly.

Restore the power, and enter and run Listing 1, the clock test. A running clock display should appear on the screen. If you do not get a running display, recheck your work, especially the swap circuitry, the insertion of the integrated circuits in the sockets, and the polarity of transistors and diodes. *Remove U10 before making any changes!*

When this test is complete, you may finish hooking up the battery. Let the system charge for about an hour. *(end)*

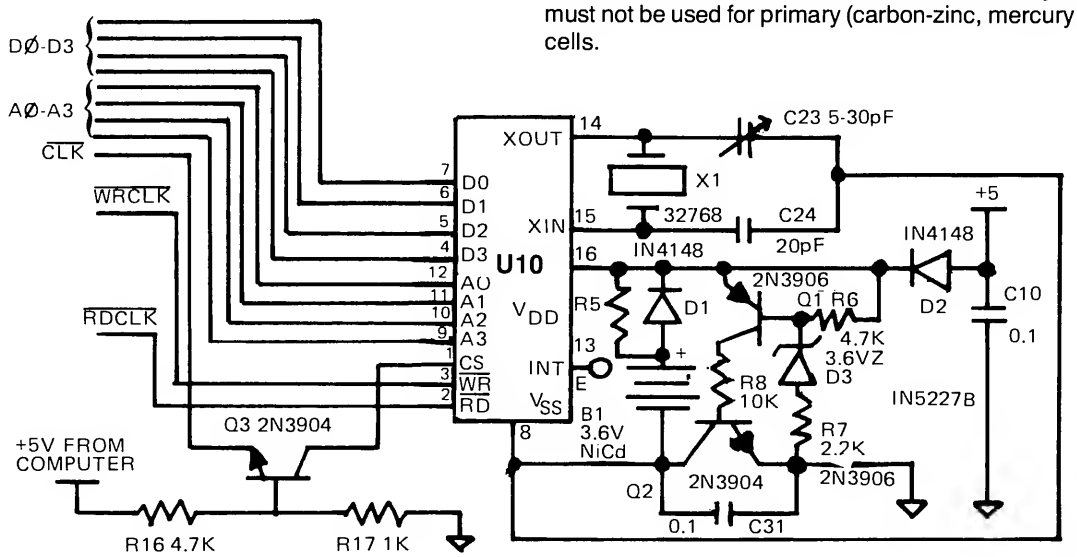


Figure 6. Clock/calendar module uses a battery backup; R5 must not be used for primary (carbon-zinc, mercury or lithium) cells.

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Entry Way

By Mike Rigsby

Voice actuation—visions of the future. It doesn't have to be so, and for users with motor skill deficiencies, voice actuation, single-keystroke actuation, or contact actuation are imperative to computer use. Let's look at ways to simply and inexpensively implement these actuation methods.

The program and equipment we will use must be set up by a person with appropriate physical capabilities. Loss of electrical service, however brief, means the software must be reloaded. If this is a problem, you should consider an Uninterruptible Power System (UPS). UPS systems often cost $400 or more.

This project is accomplished in two parts—hardware and software. Let's look at each in turn.

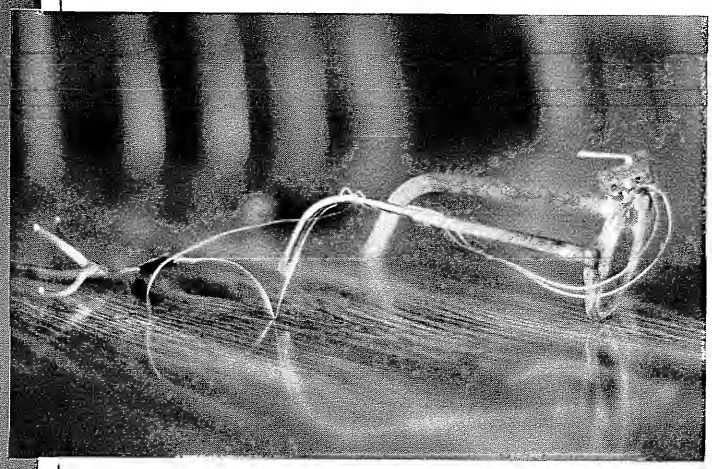


Photo 1A&B. Eyebrow Switch

Hardware

Voice control of the computer requires equipment for sound input. Sophisticated amplifiers (even the one on your inexpensive cassette recorder) generate noise that the computer is sensitive to. Use the Radio Shack mini-amplifier, part 277-1008 with any microphone. Adjust the volume to the midpoint. A battery *eliminator* rather than a battery could cause problems if used on the amplifier. Remember that background noise, or too much amplification, creates false signals.

Contact control comes from the joystick, and can be tested by depressing the fire button on the right joystick. Any normally open contact could be substituted for the fire button, but it must be wired into a plug which fits in the joystick jack.

The eyebrow switch can be used only if the user has sufficient muscle control to lower the eyebrow in a deliberate blink. A normal "eye wetting" blink does not cause enough deflection of the brow. Any activity which can be controlled and result in a switch closure can be used to operate this program.

Software

The software (see the Listing) produces a display (see Fig. 1). A rectangular cursor appears by the leftmost star and flashes for a brief time period next to each star, moving from left to right and repeating its sequence until a control action is taken.

Let us assume that control is being taken from an eyebrow switch. Assume that the cursor is in the second position (above the column containing C, D, H, N, S, T). I blink my eye and the cursor will travel down the column instead of continuing across the top of the row. When the cursor is next to the letter H I blink my eye again; H appears on a message line on the lower portion of the video display. The cursor then returns to the leftmost star and commences its movement to the right again.

But what if? What if I only blink once? The cursor would travel down the column, then return to the leftmost star (home position) and begin again. What if I blink at the wrong letter? The BK position (fifth column) will backspace and erase one position on the message line. SP generates a space, PR causes the message line to be output to a printer, and SPEED generates a new display. The speed display lets me, through an eye blink, increase or decrease the amount of time the cursor spends at each location—the numerical value of the timing constant is given here. Warning: going to the SPEED display causes anything on the message line to vanish!

The message line is 64 characters long (two lines on a tv). Any attempt to produce a 65th character will result in automatic printing of the existing 64 characters.

Connections

Three methods of input are allowed: keystroke (subroutine at line 500); voice (subroutine at line 1500); and switch (subroutine at line 2000). The voice and switch subroutines include a small time delay (for—next loop) to decrease problems which could occur as a result of long sounds or contact bounce.

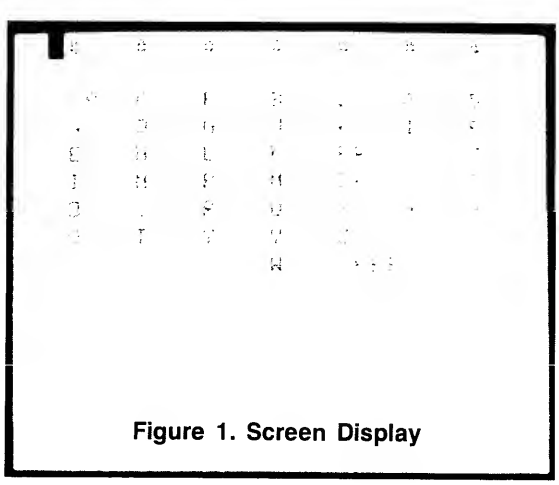
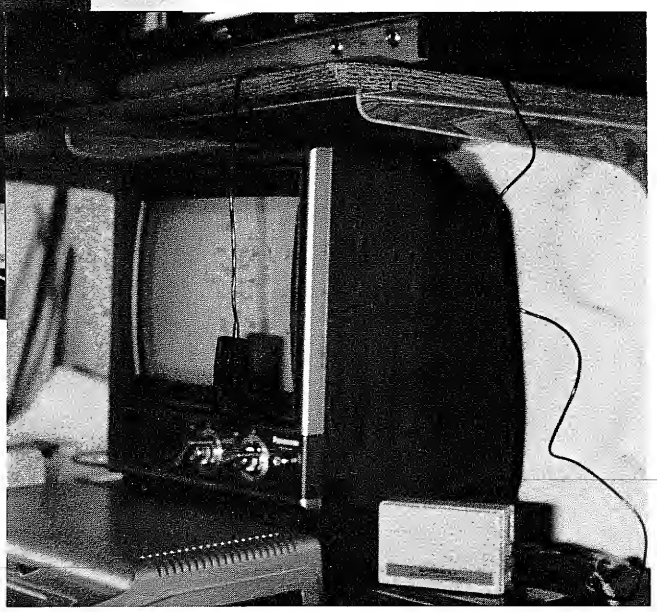


Figure 1. Screen Display

Photo 2A&B. Voice Actuation



I found making BK work a little tricky; the first activation must erase the present character position on the message line; the second sequential BK must erase the present position minus one. Placing a character on the message line after a BK command requires placing it at the present position, not the present position plus one.

I based character placement on frequency of use, not alphabetical order, hoping to increase the speed of operation. If your printer is configured to run at 1200 baud rather than 600, add a line:

3025 POKE 150,41

Figures 2 and 3 are designs for en eyebrow switch and for voice control. Single keystroke actuation is accomplished via the subroutine beginning at line 500; audio via the subroutine beginning at line 1500; and contact via the subroutine beginning at line 2000. *(end)*

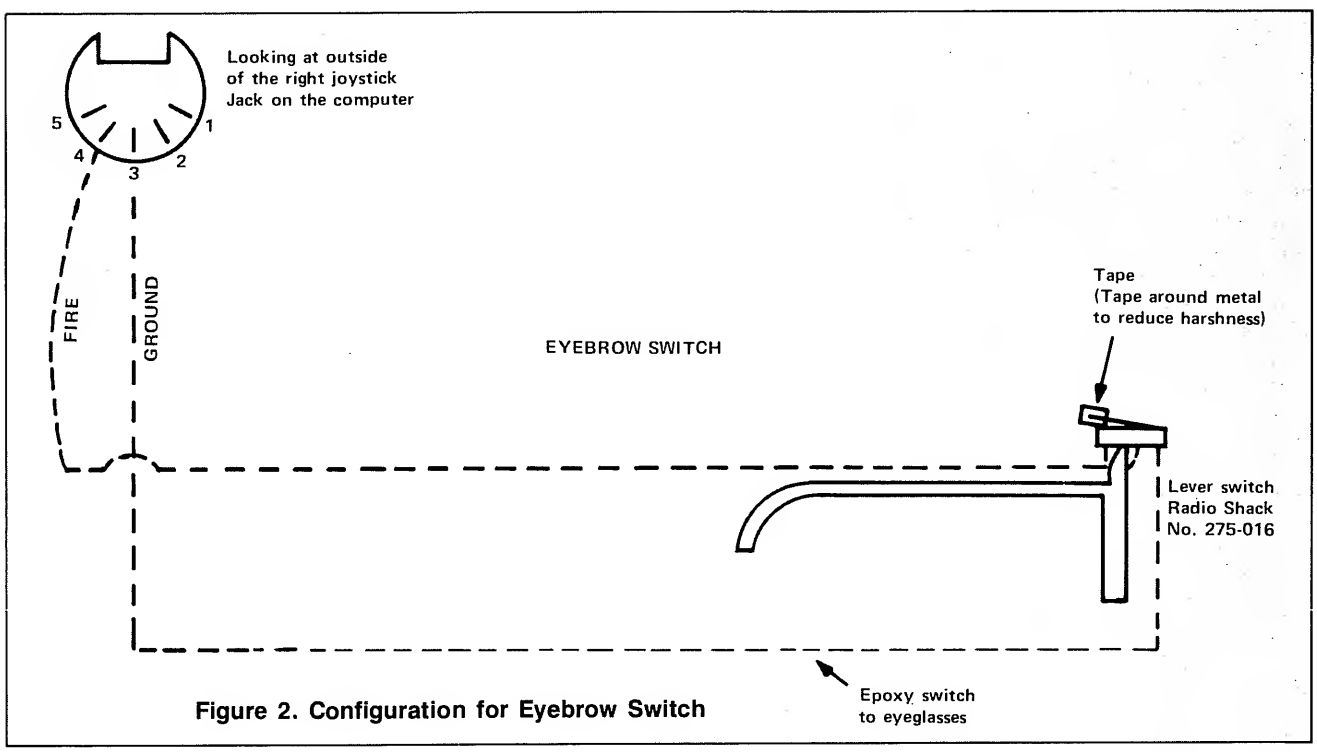


Figure 2. Configuration for Eyebrow Switch

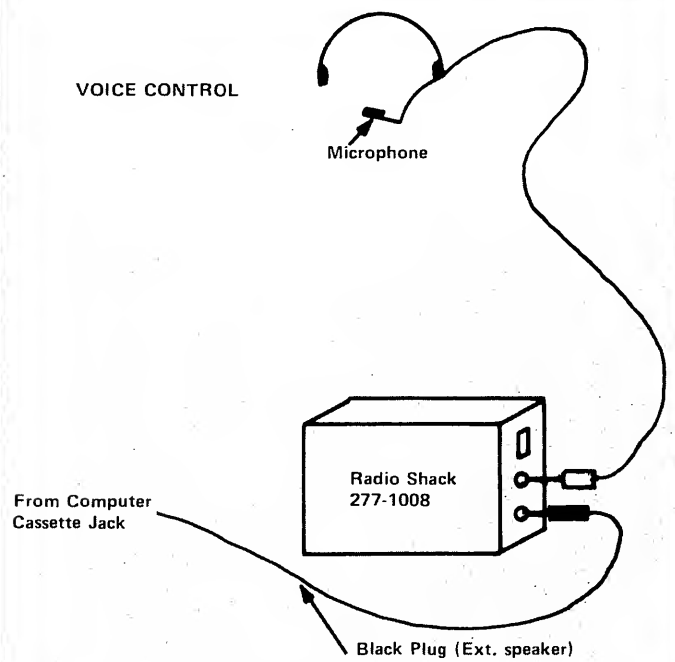


Figure 3. Configuration for Voice Control

Program Listing. Entry Way

```
0 GOTO 3000
1 INPUT"FOR KEYBOARD, TYPE '1'          FOR AUDIO,
TYPE '2'                FOR EXTERNAL SWITCH, TYPE '3'"
;Q
9 N=50
10 CLS
15 R=1407
16 R1=0
20 PRINT@3,"#   #   #   #   #   #   #"
30 PRINT@67,"SP  C   F   B   .   0   5"
40 PRINT@99,"A   D   G   J   ,   1   6"
50 PRINT@131,"E   H   L   K   PR  2   7"
60 PRINT@163,"I   N   P   M   BK  3   8"
70 PRINT@195,"O   S   R   Q   X   4   9"
80 PRINT@227,"U   T   Y   V   Z"
90 PRINT@271,"W   SPEED"
100 X=1026
110 POKEX,128
120 ON Q GOSUB 500,1500,2000
130 POKEX,143
145 IF B=1 THEN 180
150 X=X+4
160 IF X=1054 THEN X=1026
170 GOTO 110
180 X=X+32
181 IF X<1083 THEN X=X+32
182 IF X=1282 THEN GOTO100
183 IF X=1286 THEN GOTO100
184 IF X=1290 THEN GOTO 100
185 IF X=1326 THEN GOTO 100
186 IF X=1330 THEN GOTO 100
187 IF X=1270 THEN GOTO 100
188 IF X=1274 THEN GOTO 100
190 POKEX,128
200 ON Q GOSUB 500,1500,2000
210 POKEX,143
215 IF B=1 GOTO 700
230 GOTO 180
500 B=0
501 FOR Y=1 TO N
```

```
502 A$=INKEY$
504 IF A$=""THEN 510
506 B=1:GOTO520
510 NEXT Y
520 RETURN
700 IF X=1090 GOTO 800
702 IF X=1170 GOTO 900
704 IF X=1202 GOTO 1000
706 IF X=1298 GOTO 1100
709 X=X+1
710 Z=PEEK(X)
715 IF R1=R THEN 750
720 R=R+1
725 IF R=1473 THEN 900
730 POKER,Z
740 GOTO 100
750 POKER,Z
760 R1=R1-1
770 GOTO 100
800 Z=96
810 GOTO 720
900 X=1408
910 T1=PEEK(X)
915 IF T1=96 THEN T1=32
920 B$=CHR$(T1)
930 A$=A$+B$
940 X=X+1
950 IF X=1473 THEN 990
960 GOTO 910
990 PRINT#-2,A$
995 GOTO 10
1000 IF R1=R THEN R=R-1
1010 R1=R
1015 IF R=1407 THEN R=1408
1020 Z=96
1030 GOTO 730
1100 CLS
1110 PRINT@10,"CONSTANT";N
1120 PRINT@67,"FASTER   SLOWER   RETURN"
1130 X=1090
1140 POKEX,128
1150 ON Q GOSUB 500,1500,2000
1160 POKEX,143
1170 IF B=1 GOTO 1200
1180 X=X+9
1190 IF X>1110 THEN X=1090
1195 GOTO 1140
1200 IF X=1090 THEN N=N-5
1210 IF X=1099 THEN N=N+5
1220 IF X>1099 THEN GOTO 10
1230 GOTO 1110
1500 B=0
1501 FOR Y=1 TO N
1502 L=PEEK(65312)
1504 IF L=3 THEN 1510
1506 B=1
1507 FOR Y6=1 TO 20
1508 NEXT Y6
1509 GOTO 1520
1510 NEXT Y
1520 RETURN
2000 B=0
2010 FOR Y=1 TO N
2020 P=PEEK(65280)
2030 IF P=255 THEN 2100
2040 IF P=127 THEN 2100
2050 B=1
2052 FOR Y7=1 TO 10
2054 NEXT Y7
2056 GOTO 2110
2100 NEXT Y
2110 RETURN
3000 CLS
3010 PRINT"THIS PROGRAM PROVIDES VOICE OR  SINGLE M
OVEMENT CONTROL OF A    PRINTER.  INPUT MAY BE ACCE
PTED FROM THE COMPUTER KEYBOARD, OR"
3020 PRINT"A MICROPHONE AND AUDIO AMPLIFIER(RADIO S
HACK 277-1008), OR FROM AN EXTERNAL SWITCH CONTACT
WIREDTHROUGH THE RIGHT JOYSTICK PORT."
3030 GOTO 1
```

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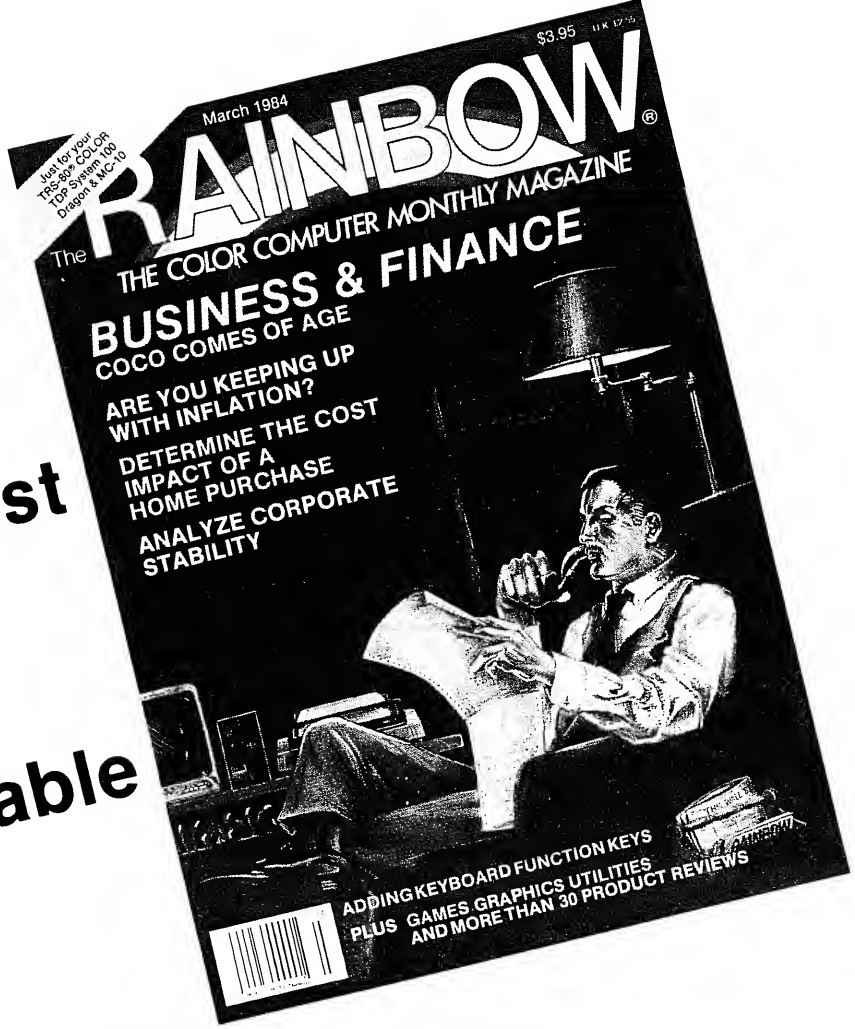

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★★**Fm: Arthur Doyle** (to Marty)

I hope they win despite themselves. It's been a good Chevy with never much of anything to depreciate. If compatibility becomes a problem with the Mod 9, why don't they simply add a board that will run CoCo? Their manufacturing costs can't be much over $20/board.

•**Fm: Arthur Doyle** (to S. Trevor)

Maybe our luck will hold, and programmers such as Marty will upgrade our software to work with the new machine.

••**Fm: Wayne Day** (to Marty)

Condemn me if you will . . . the simple fact remains that if a programmer would include all the necessary routines for running his program in his file, it would be self-supporting, and run on any of the machines released so far.

For a programmer to not do so indicates one of a couple of things:

1. He does not care about future compatibility.
2. He intends to take care of future compatibility later.
3. He doesn't know what compatibility is, and/or doesn't care.

There are a couple of other possibilities, too, that can't be put down where children might get at them.

A good case in point is Colorcom/E. Anyone have problems with that one? Nope, 'cause Mark Davidsaver was smart enough and cared enough to write his own code—and Mark's program is one of the premier examples!

You have many, many times spoken ill of the programmers of the Basic ROMs we all have—yet, here you are saying that "no matter how bad they are, they must stay the same."

It doesn't make sense, Marty, when Tandy told everyone from the very beginning not to use anything except the published entry addresses.

Take a look at Vidtex, for example . . . it checks to see which version you're using, and makes corrections based upon that info. That's a smart way around the problem of using direct calls to undocumented routines.

What about all the problems with JDOS and, though I haven't heard of too many people using it yet, Spectrum DOS? If a commercial program was self-sufficient, there wouldn't be the compatibility problems, would there?

No, I'll continue to stand by my belief . . . a progrmmer who doesn't build his product so that it is ROM-version independent is either lazy or doesn't care. Or, he's not smart enough to do it, which means he probably shouldn't be foisting something off on someone in the first place.

(This sparked three replies, following.)

Fm: Marty (to W. Day)

I agree with the spirit of your remarks, but once again I feel that the lack of documented disk file I/O vectors in the R/S DOS is an unpardonable oversight, making it an unreasonable hassle to keep up with version changes. Example: Neither Colorcom/E nor Vidtex are likely to run on the 09 machine, because from what I hear Tandy *will* continue to support the documented vectors, but *no* others. As for detecting version numbers and then acting accordingly, that's a band-aid solution—better than not trying to use a band-aid, but a band-aid nonetheless. It doesn't help you when a truly new ROM version comes out that you never heard of. Besides, there are a number of different ways to check version numbers. Some are better than others. Yes, in principle, the better, less lazy programmers will and do produce code likely to last longer and through more CoCo versions. But that in no way gets Tandy and Microsoft off the hook for their failure to include documented file handling vectors.

(One reply follows, marked ★.)

Fm: A. Flexser (to W. Day)

Wayne, I'm completely in Marty's corner on this one. Vidtex should be subject to the same criticism as other third party software, if you want to be consistent. In checking for ROM version, it is no different than virtually any other program that uses undocumented ROM calls. They were too "lazy" (by your definition) to write their own disk I/O, and they are therefore vulnerable to arbitrary ROM changes that R/S decides to foist on us. Does that make it a bad program? Decidedly not! They picked the most efficient way to accomplish what they wanted, given the asinine lack of file-handling vectors.

To have done otherwise would have chewed up a lot of memory space better used for the sake of a larger buffer.

(This has one reply, to be published next issue, marked ☆.)

Fm: Dennis Bathory Kitsz (to W. Day)

. . . or *she*. No wonder computing's called a male priesthood.

★Fm: Wayne Day (to Marty)

I believe, Marty, we're talking about two different things here . . .

I would prefer, as probably most folks would, that Tandy and Microsoft use consistent entry points or vectors for the ROM calls, but they have chosen not to. That's an entirely different thing than what you condemned me for.

The point of my previous message that drew your intense ire was my contention that, due to laziness, lack of caring, or lack of knowledge, programmers who build software for the commercial market are not doing the best they could when they use undocumented ROM calls, instead of writing their own code so their programs would be ROM-version independent.

Colorcom/E does it the right way—he wrote all his own code from what I understand. Vidtex did it another way.

Blaming Tandy because they played by the rules they established from the very beginning achieves nothing constructive. Encouraging software writers to learn more about the machine they are writing for, and encouraging them to write a self-sustaining code, would be doing more of a service to the CoCo industry.

(This drew three replies, following.)

Fm: A. Flexser (to W. Day)

P.S. Another nice thing about "laziness' is that you can have a certain amount of confidence that your disk routines have been reasonably thoroughly debugged to begin with. Davidsaver's praiseworthy efforts to not use undocumented ROM calls have cost me a couple of bad downloads, on account of his having no check for a disk full error (it just omits part of the file if there's no room, and doesn't say boo!)

(One reply follows immediately:)

Fm: Wayne Day (to A. Flexser)

Hmmm . . . that's one I've never run up against . . . guess it's because I keep checking to see how much space I've got on the disk, huh?

(And two answer this, immediately following:)

Fm: Marty (to W. Day)

Experienced users and system freaks (like you and me) are less likely to be plagued with minor deficiencies than many others, as we've gotten good data handling habits and generally stick to them. But even experienced and intelligent folks like Art can still get trapped in a moment of weakness by lousy code, often encouraged by crummy operating systems like Microsplotch's.

and:

Fm: A. Flexser (to W. Day)

Or, yer just lucky!

Fm: John Ross (to W. Day)

Check out the programs from Spectral Associates. They work on all ROMs, and even the Dragon, because they contain all the code needed for and by the program. They don't dip into the ROMs at all! That's the way it *should* be done!

(One reply follows, to be published next issue, marked by ★★.)

Fm: Marty (to W. Day)

Wrong again! It still would be possible to provide documented file handling calls in an upcoming ROM version. Tandy nearly did it in the Deluxe. But complacent apologists for lousy operating system design don't help matters!

(One reply follows:)

Fm: A. Flexser (to Marty)

Of course, anyone using such documented calls would then be incompatible with all earlier ROM versions, which could be considered a serious drawback!

(A reply follows:)

Fm: Marty (to A. Flexser)

True as far as your statement goes . . . but as of now there are two sets of file handling calls. If a third disk ROM is introduced with vectors, there will be three cases to cover: the undocumented calls from disk 1.0, the undocumented calls of disk 1.1, and the documented calls of disk 1.2. There's nothing that can help that, outside of a time machine. However, if disk 1.2 has documented calls, it will at least nail down the number of different ROM types to check for in file handling to three, forevermore, through whatever further revisions of the ROM ever occur. That, at least, will be worth something.

Wayne generally shows such good sense in his advice and observations. He really is a very savvy computer type with usually an outstandingly good overview of multifaceted problems. I'm really surprised to see him here defending what essentially every good programmer I've ever met has agreed was a major—probably the biggest—blunder in the design of the CoCo's ROMs. While it's true I welcome an opportunity to light into anyone and have a good, fair fight over an issue, I honestly wonder why Wayne picked that issue to defend.

(Two replies follow, to be published next month, marked ☆☆.)
(end)

Off Color: Sleepy Head

By Richard Ramella

Your Color Computer is what it is partly because a 16th Century boy was allowed to sleep late.

His name was Rene, and he attended a Jesuit college at La Fleche, France. The Society of Jesus (SJ) was founded in 1534, and was well established by the time young Rene became a student. From the start, the Jesuits built their rep on the quality of education they offered.

At the time of our story, Rene was adjudged not in the best of health. Consequently, he was permitted to stay in bed until noon. The accounts I've read don't say whether this was permitted on Sunday; I doubt it. Also, I doubt many Jesuit colleges operate that way these days.

So there's the kid, grinning, snoozing and goodness knows what else, until time for lunch. You'd think such a boy would amount to nothing!

But then came the slugabed's idea.

He pictured two lines intersecting at right angles, that divided a field into quadrants. The value of the intersection of the lines was zero. He pictured the entire arrangement divided into increments of any uniform size. Maybe he didn't think this at the time, but let's call the across increments X, the down increments Y. In this way, the X values right of zero are plus, those to the left are minus. The Y values below zero are minus, the ones above it plus.

Let us now pause while three centuries pass. Zap! The computer is invented. Someone remembered what the sleepyhead came up with and decided to apply it to computer graphics.

So that's why, on your Color Computer, you can SET and PSET color graphics points on the screen. The system used by computers is not quite the same as that envisioned in bed by Rene; the across X positions begin at the top screen left with a zero and work rightward; the Y positions begin at the same place and work down the screen. What is important is this: It requires but two numbers to specify a given point on a rectangular two-dimensional field. It's called setting Cartesian coordinates.

Young Rene was Rene Descartes, who became more famous for his ideas in philosophy than mathematics.

In Color Basic you can set graphics points 0–63 on the across X axis, and 0–31 on the down Y axis. The form is SET(X,Y,C), with C standing for a color numbered from 1–8. In Extended Color Basic the highest resolution lets you PSET coordinates 0–255 for X, 0–191 for Y.

Rene "I think, therefore I am" Descartes had no intention of laying any of the groundwork for computers. If he had foreseen some of the mundane results of computer graphics he might have attached a rider to his concept stipulating "No aliens, please!" But the future works with the past as it will.

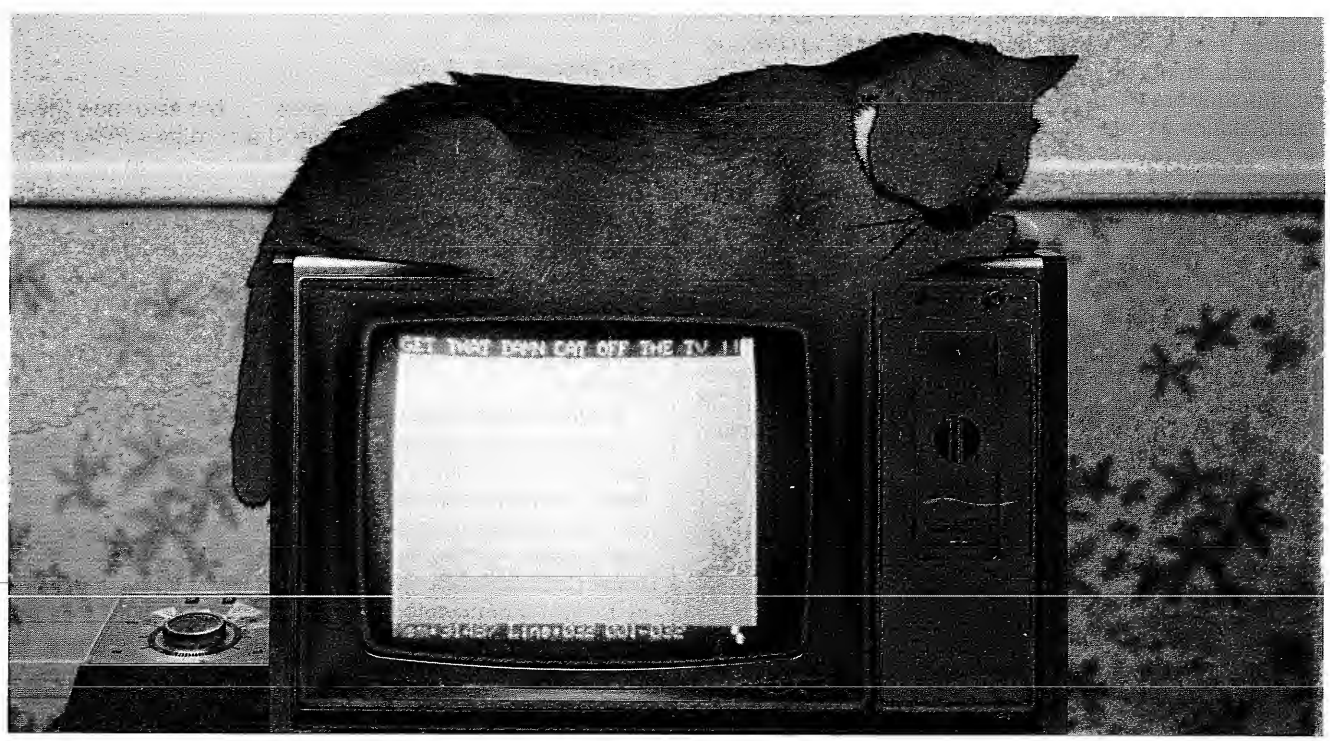
In a larger sense, Cartesian coordinates laid the groundwork for analytical geography. Suddenly geometricians could portray the paths of equations. Sine waves, log expressions, circles, curves, parabolas, wheat harvests, mortality rates, projections—mathematics was given a kind of physical reality that led to new understanding.

I'll stop here because I am wise enough to realize I could easily get in over my head if I tried to explain much more. Things like graphic representations of regular and periodic phenomena: radio, sound and light waves. Or rates of growth, imaginary numbers, stock market projections, bell curves. And stuff like that.

One thing is certain: even if it's Wednesday, we should all stay in bed until noon tomorrow and see what ideas come to mind in that somnolent, creative time from 7 a.m. to noon.

If the boss calls, tell him we're thinking about serious stuff.

(end)



Blue Skying It:

Ideas That Got Away . . .

By Bill Barden, Jr.

Hackers are getting a lot of bad press these days. Our local television press has gotten much mileage out of a special report on computer hackers and how they're using modems to break into all kinds of secure data processing systems, such as NORAD and the Acme Dry Cleaners Bulletin Board system. They've made it appear that any computer owner with a modem should be only slightly above John Dillinger on the most wanted list. Let me go on the record, however, as saying that I *love* hackers and hacking. But the old kind of computer hacking—the sudden insight into a real-world problem that could be computerized to amaze and amuse your friends and make you a hero to your spouse or magazine editor. Let me give you some examples of wild and crazy ideas, that, Von Neumann willing, I'm going to implement some day.

The Cheap Christmas Light Billboard Caper

My latest idea occurred when my early December flight had a near miss at Los Angeles airport with the Goodyear blimp. The collision was avoided only because the blimp pilot had flashed a WATCH IT, COWBOY! message on the blimp's display as the 747 turned into its final leg on the approach. The display got me thinking. Why not make my own animated billboard driven by the CoCo? It could consist of LEDs or incandescent lamps. LEDs cost about 10 cents apiece, if you find the right electronics store. Incandescent lamps are about 60 cents apiece, normally, but I'll be darned—those small Christmas lights are only $2.00 per 50 lights—4 cents apiece!

If I got some pegboard, drilled out the holes so that I could press fit the small bulbs . . . How many would I need in a matrix . . . Let's see—64 by 24 would be 1536 lamps. I rushed down to the local drugstore and confiscated 35 strings at about $70. I spent the rest of the afternoon drilling out holes on a pegboard and then popping off the lights from the strands.

Then I got to thinking about the way I would *drive* the lights from the CoCo. I knew that I would not have to turn off each one at the same time, requiring 1536 discrete lines, transistor drivers, and so forth. My idea was to *multiplex* the lights the way LED displays are multiplexed. Multi-digit LED displays are turned on one digit at a time at a high current, and hence greater brightness than normal. A four-digit LED display, for example, turns on one digit for one-fourth of the time at four times the current. The eye integrates the brightness and comes up with an average brightness equivalent to a normal LED brightness. In doing this, you've saved three-quarters of the electronics that would be used for addressing all lights.

The same *multiplexing* could be done for the Christmas light incandescents. However, I soon learned that there were several problems I hadn't thought of. One major stumbling block was the amount of current those little beasties take. Would you believe 130 milliamps at 2.5 volts? Putting it another way, to drive 1536 lamps directly from a 20 volt supply would require at least 200 amps, something comparable to an arc welder! Even with multiplexing the lights it would require, say, one-eighth of the current, or 25 amps.

Another "gotcha" I hadn't considered was the *inrush* cur-

rent. It turns out that a cold lamp may requires as much as 10 times the current as a warm lamp, making the worst case power requirements 200 amps again, even with multiplexing! I could see screwdrivers and pliers arc-welded together as I turned on the display . . .

Another problem, which I knew could be surmounted, was how to fan out signals for the display, about 192 discrete outputs, even with multiplexing. I had envisioned a tree of 8255 PPIs driven by a general-purpose interface in the CoCo's ROM port. However, additional transistors or drivers were required to handle the high currents. Let's see, 192 times one dollar's worth of parts for each output . . . obviously more thought was required.

To sum it all up, my Christmas display, with Merry Christmas messages and animated toy shop scene, wasn't operative for the '84 holiday season, but I have big plans for next year. Feasible? Definitely—think current limiting resistors for the incandescents or LED lights and cheaper drivers.

The Line Printer Digitizer Fiasco

In the throes of finishing a Radio Shack book ("How to Use Your Radio Shack Printer"—out soon) I dearly wanted to implement an idea I had seen years before—a digitizer that operated from a printer. The basic idea in digitizing is that a photocell moves across the paper in much the same fashion as the electron beam in a television picture tube. The light and dark areas of the paper reflect greater or smaller amounts of light which are converted by the photocell into voltage. The voltage can be fed into the CoCo's joystick port and measured. (The joystick port really varies the resistance of two potentiometers, producing a voltage measured by the CoCo. The voltage measured is converted to joystick position value.)

A printer digitizer uses the basic printer mechanism to move a photocell mounted on the print head—after all, you can "scan" lines on many of the newer Radio Shack printers at 1/60th of an inch or less vertically, and move the print head horizontally under program control as little as 1/180th of aninch. Several people had tried it with other systems, but I had not seen any for the CoCo.

To get some ideas on the project, I called my expert on photo optics, Forrest Mims of Computers and Electronics and MITS fame. He had just completed some experiments using Radio Shack's cadmium sulfide photocell, and it worked fine for digitizing. However, the resolution was rather coarse and the CS photocell somewhat slow in response to changing light levels. He recommended phototransistors with a fiber optic light source. (Forrest loves anything with a fiber optic cable and was once seen trying to tap Pac Tel's massive San Francisco fiber optics routing with a mirror and photodiode.)

I had a better idea . . . why not use a laser I had bought from Edmund Scientific for another unfulfilled project—a laser burglar alarm system? The light source could be very precise and should produce excellent resolution for digitizing text or images. I envisioned the laser pointing in to a mirror on the print head mechanism and reflecting from the paper. I never did implement the idea, but I intend to. However, at Comdex in Las Vegas, I saw Apple's new digitizer; it looked suspiciously like a stripped down printer mechanism with a light source and photo detector . . . .

The Home Weather Station Disaster

Even though Southern California is not "weather active" (we had a thunderstorm a few years ago), a persistent blue sky project keeps raising its ugly head in my 2:00 a.m. CoCo

dreams—the CoCo could make a great home weather station. It's cheap enough—you could leave it hooked up and accumulate windspeed, temperature readings, humidity, and other weather variables. As a matter of fact, I did *partially* implement this idea. Several years ago, I wrote an article for *BYTE* magazine in which I described a CoCo anemometer. The anemometer (windspeed device) was made out of doweling and plastic cups attached to PVC sprinkler pipe parts. A hole in the shaft interrupted an infrared light beam from a Radio Shack infrared diode. The light beam was detected by an infrared detector. When the anemometer shaft spun, a pulse was produced which could be read and measured by the CoCo joystick switch input. It worked great, until we had the Big Wind of '83 (15 miles an hour).

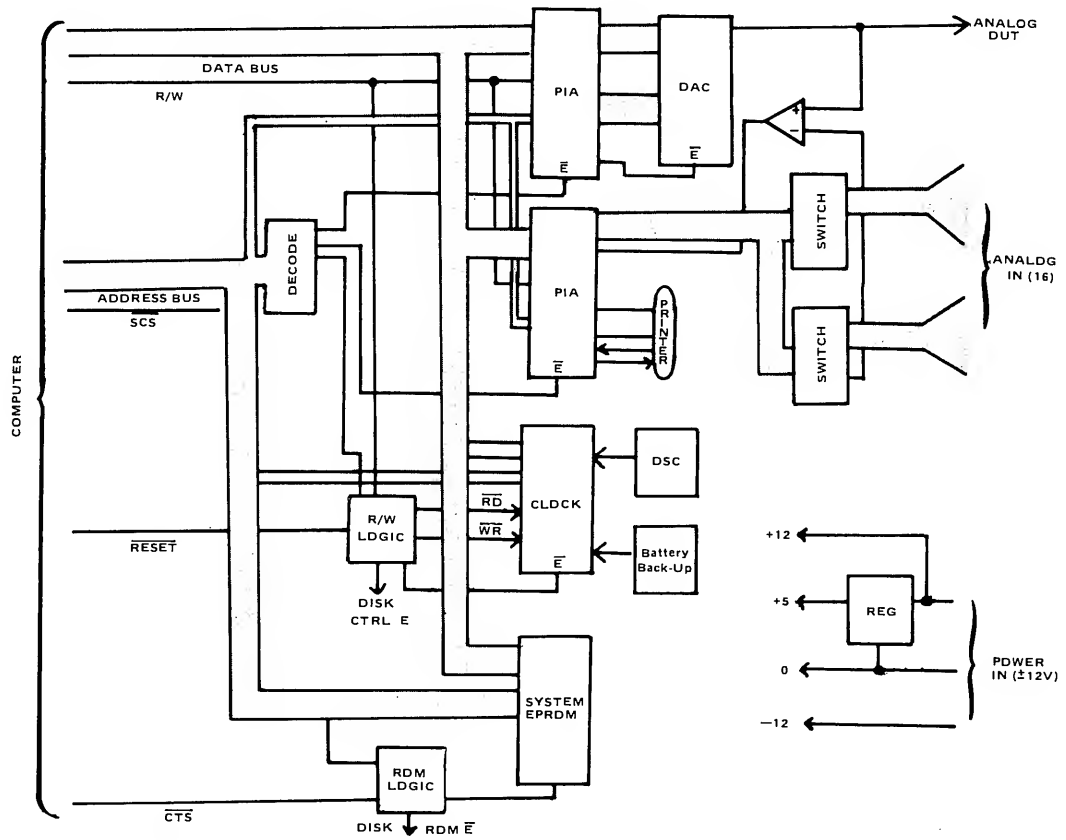
I thought the infrared diode and detector was an elegant approach to measuring shaft rotation speed until I happened to put together a Heathkit Wind Speed/Direction indicator. Heath, eschewing sophistication, uses magnetic reed relays and magnets for their shaft rotation speed sensing!

My plan now is to build a complete home weather station using the CoCo. It would have magnetic reed relays to sense windspeed, an LM-334 temperature sensor, a National LX series pressure transducer for barometric pressure, and a potentiometer direction indicator. All of these signals could feed into the CoCo joystick port, with a little additional electronics. Feasible? No question about it. If I can just find the time . . . .

And that's what I mean about hacking. It's a lot of fun, even though many of the projects only get finished in your mind. For more on hardware hacking, follow Dennis Kitsz, certainly, but also look at Forrest Mims' *Engineer's Notebook* (Radio Shack), Bruce Artwick's *Microcomputer Interfacing* (Prentice Hall), and some of Don Lancaster's books (Howard Sams). Give me a call at 2 a.m. if you get the laser digitizer working . . . *(end)*

A Correction

The accompanying Figure is the block diagram referred to in the end of Part I of the Data Gatherer, issue 3. We found it cowering in its folder at midnight one night. This is a *sin of omission*, so far we have produced no *sins of inclusion*.



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*** NEWS FROM UNDER COLOR **** NEWS FOR UNDER THE COLORS ***
********** Compiled February 19, 1985 **********
** Send news to: Under Color, Box 6809, Roxbury, VT 05669 **
********** CompuServe 70136,1257 **********
****

YES, THERE IS ANOTHER REVISION COCO ... UNDER COLOR verifies that a new Tandy Color Computer has quietly been released boasting BUILT-IN LOWERCASE. This unit, the 26-3134B/3136B, has a redesigned circuit board with fewer components and Motorola's 6847-T1 lowercase video display generator. DON'T TRY TO GET ONE, though. Stores can't get their hands on the new units until they DUMP THE STOCK THEY'VE GOT. More later when we get one to test . . .

* * * * *

Speaking of revisions, EVERYBODY'S DOING IT WITH DISK CONTROLLERS. The new, 28-pin Western Digital 1773 disk controller has begun popping up everywhere, including INSIDE RADIO SHACK, J&M and HDS. The reason? Fewer and smaller components. The 1773 has a BUILT-IN DATA SEPARATOR for increased reliability, and requires less board space and a smaller socket. BUT WHAT DOES IT MEAN FOR YOU? It means that some protected software WON'T RUN on the new system, because the fancy footwork used for MIXED-DENSITY TRACKS (alternating single and double density sectors) DOESN'T WORK WITH THE 1773. UNDER COLOR has learned that Tom Mix and other vendors have been using this protection scheme, and are SCRAMBLING TO ACCOMMODATE the new controllers. By the way, YOU CAN'T IDENTIFY the new Tandy controller unit, since it's sold with the IDENTICAL CATALOG NUMBER to the previous one!

* * * * *

Your own 64K UPGRADE for the Korean Color Computers (26-3134A/B, 3136A/B) can be done with JUST TWO MEMORY CHIPS. The memories are Texas Instruments type TMS4464 or NEC type uPD41254 (yes, 41254, NOT 41256, which is another type), and currently sell for about $20 each. If you order a 64K upgrade from a NON-TANDY SOURCE, BE SURE TO INCLUDE YOUR COMPUTER'S CATALOG NUMBER. (For our technical readers, the new chips are 64K x 4 dynamic memories, with on-board data bus transceivers, eliminating the need for the octal buffer used for 64K x 1 memories in the earlier CoCos).

* * * * *

Yes, COLOR MICRO JOURNAL is gone. The death of CMJ makes it the third COCO MAG TO BITE THE DUST in recent times, along with Color Computer News and The Color Computer Magazine. We're sorry to see CMJ go; it served well the needs of the minority of CoCo users with a technical point of view.

* * * * *

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REPORTS FROM THE IRVINE (CA) RAINBOWFEST indicate several trends: (1) CoCo support companies are consolidating their efforts. Many of the SMALL COMPANIES WERE MISSING from this show, but their products were on display via distributors. (2) OS-9 IS MAKING HEADWAY. Long lauded by dedicated users, the OS-9 disk operating environment is being supported by more and more software. (3) CoCo products from non-Tandy suppliers are selling better than ever, as users plunked down UP TO $10,000 at every booth.

* * * * *

Speaking of Rainbowfest, users got a FIRST-HAND LOOK AT COCOMAX, the CoCo clone of the Apple "Macpaint" graphics design program (reviewed in our last issue). UNDER COLOR will have a full rundown of the new products soon. In random Rainbowfest news, Green Mountain Micro, whose past show pranks have included a party booth, a beach booth, and a sophisticates booth, pulled their BEST PRANK YET -- they didn't show up. Instead, fliers telling of "a terrible, insidious, new chemical potion" which made them invisible were piled high in their booth. SPECTRUM PROJECTS' Bob Rosen commented, "If this works, I'm not going to the next show, either!"

* * * * *

UNDER COLOR apologizes for its lateness over the past few weeks. The editors and staff have an INBORN LACK OF COORDINATION that results in them falling over each other even though they are 300 miles apart. We'll be catching up to our schedule over the next few months. And please! Nobody start any rumors that we're going to vanish. Except for the aforementioned congenital stumblicity, WE'RE DOING FINE.

* * * * *

The NEW JOYSTICKS from Radio Shack now have the missing "sixth pin" and a MYSTERIOUS BLACK BUTTON running to ground. In fact, the joysticks SEEM TO BE THE MODEL 1000 TYPE, which means they might just be the answer for DUAL-BUTTON CONTROL SYSTEMS such as the one needed to run GRAPHICOM. Unfortunately, the CoCo itself doesn't make use of the extra connection pin or button; we'll report shortly on a "cross wire" solution to firing up BOTH BUTTONS ON EITHER JOYSTICK.

* * * * *

Reviews

ADOS

By Arnold Kahn

PRODUCT
ADOS
SpectroSystems
11111 N. Kendall Drive, Suite A108
Miami, FL 33176
64K; One or more disk drives required
$27.95 + $2 shipping, Disk

ADOS is a package of enhancements for Disk Extended Color Basic. When entered as a program loaded from disk, it adds many new commands and conveniences to Microsoft Basic. But when installed as a ROM, in addition to providing enhancements it offers a solution to the software incompatibility problems that have caused so much disappointment to Color Computer owners with disk drives having version 1.1 ROM in the controller. It is the fix for the compatibility problem that makes this software of special importance to the Color Computer community.

To run ADOS from disk you must have a 64K computer; any version is satisfactory. To run it from a ROM in the disk controller you need not have 64K. However, in order to customize it properly, in advance of getting it put into a ROM, you must first run it from disk. So, for all practical purposes, 64K is required.

First some description of the enhancements: When loaded from disk (or on power-up with the ROM version), Basic comes up with a new ADOS logo which can be altered by the user. The enhancements require no further loading. You can turn on automatic line numbering for Basic; output can be sent to the printer as well as the screen; commands can be accepted in lowercase; and up to 22 pre-programmed control keys are available.

Perhaps the most useful commands are connected with the operating system. For example, `RUN "PROG",&H1000` will offset load and execute the assembly language PROG/BIN, and your disk will not be left spinning, either. Two forms of DIR can be used; the newer form is abbreviated and in a two-column display. Both forms give the number of granules. Assembly language disk file addresses can be listed, and ASCII files can be listed to the screen or printer. Most useful is the "repeat last command" function, which permits changes via the line editor. A faulty command can be corrected and reissued.

There is an improved Copy function which lets you proceed even if the file already exists on the target disk. And the destination can be specified by a drive number.

In the 64K mode, disk or ROM, the greatest possible memory is given to Basic. You can do such things as `PCLEAR 18` and `PMODE 4,15`! A Peep command lets you inspect and scan memory in text or graphics modes.

Provision is made for flexibility in controlling the disk drives. Custom step rates and access time changes may be installed by the owner. The RS drives run quietly at 20 millisecond stepping! Two-sided drives may be addressed. And the configuration is set up only once. For those with the newer 40 track drives or those with two-sided drives, formatting and drive addressing options are available.

Are the enhancements all perfect? Not quite, and users will surely differ here. Having cut my teeth on uppercase-only Teletype machines, and having put up with RS's reverse video, I have no love for lowercase, especially on the CoCo. Fortunately for me, ADOS's leanings toward lowercase can be overruled. The hex monitor function, like RS's ZBUG, is useful, but alas, there is no memory inspection/modify utility quite as convenient as MicroWork's CBUG M-command which displays the memory bytes in rows of eight across the screen. And most annoying to me is the keypress required before getting the prompt after a DIR. This reserves two extra screen lines for the directory, but my forgetting the keypress causes a lot of typing errors in the next command. (In a revision I received after preparing this review, it was shown how this, too, could be defeated.)

In addition to all the above built into ADOS, there are two more programs on the disk! One is a high resolution text screen, RSV, a version of RSVID, the public domain program by Steve Odneal, slightly revised to be acceptable to ADOS. The other is MENU, which allows execution of any program by placing a pointer next to it in the directory listing. It would be fine except that the pointer moves too fast; getting the right program is an arcade game in itself. (I later heard that this, too, could be changed.)

The package would certainly be worth the price for the disk form alone. However, the real attraction is that when the customized program is burned into an EPROM and installed in the controller, the user can run just about all software (including the popular Telewriter 64) compatible with Disk ROM 1.0. That is news! And the ROM version can boot OS-9 with its built-in DOS command.

What will this really cost? The proper EPROMs now sell for about $25. There are people who will custom burn a program for less than $25. Or you can buy a burner for less than $75; then you can change your mind later, erase the EPROM, and recustomize the program at no further cost. So, a ROM implementation of ADOS can be had for a bit under $80; or with your own burner, for under $130.

Are there other cures for the incompatibility problem? Radio Shack will not re-issue the old 1.0 ROM, so that is out. You can load a disk version of the 1.0 ROM when in the 64K mode, but you must individually doctor each program to remove any calls for 64K, for they will recopy your ROMs and bring back the old problem. The software seller may be able to help. Whichever way you go, each program's adaptation will be an individual case. ADOS offers a blanket cure by organ transplant, so to speak.

This program is a well-prepared and carefully documented enhancement of Disk Extended Basic. When installed as a ROM it lets any Color Computer run software incompatible with the version 1.0 Disk ROM. It is very adaptable to individual owner's tastes and hardware requirements. This reviewer will demonstrate his enthusiasm by investing in one EPROM, with which he will install ADOS in his computer. But he does not advise discarding the old 1.0 Disk ROM. *(end)*

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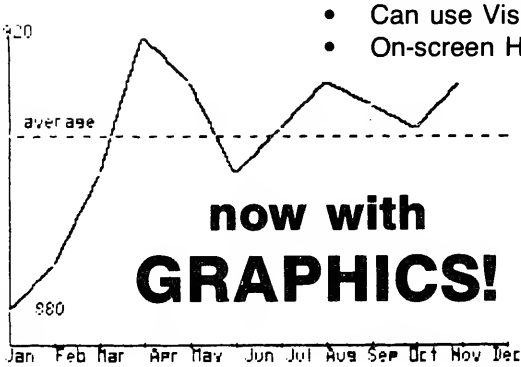

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